5. Minimum Capabilities Tests

This section describes the methods used to test the minimum modeling capabilities of candidate ACMs. There are three sets of tests: space conditioning tests, water heating tests and standard design generator tests. The space conditioning tests are performed using a simple square building prototype. The water heating tests are performed relative to several prototype water heating systems. The standard design generator tests use a single prototype building designed to have a wide variety of features. Most of the tests are performed in only five climate zones, but some require consideration in all sixteen climate zones.

5.1 Prototype Buildings

The prototype buildings are illustrated below and described in the following paragraphs. Each is presented in much greater detail on diskettes available from the California Energy Commission[1]. Letter designations are used for the prototype buildings. The letter is used as part of the label for each computer run.

A This prototype is a square box used for most of the space conditioning tests.

B The second prototype building is identical to the first except that it has raised floor construction, instead of a slab-on-grade.

C This prototype is a 3,534 ft^2, one and two-story, single-family detached custom home.

[1] Write to ACM TEST FILES, California Energy Commission, 1516 Ninth St., MS#25, Sacramento, CA 95814-5512 to obtain copies of these input files on 3.5 inch, 1.44 Mbyte diskettes.

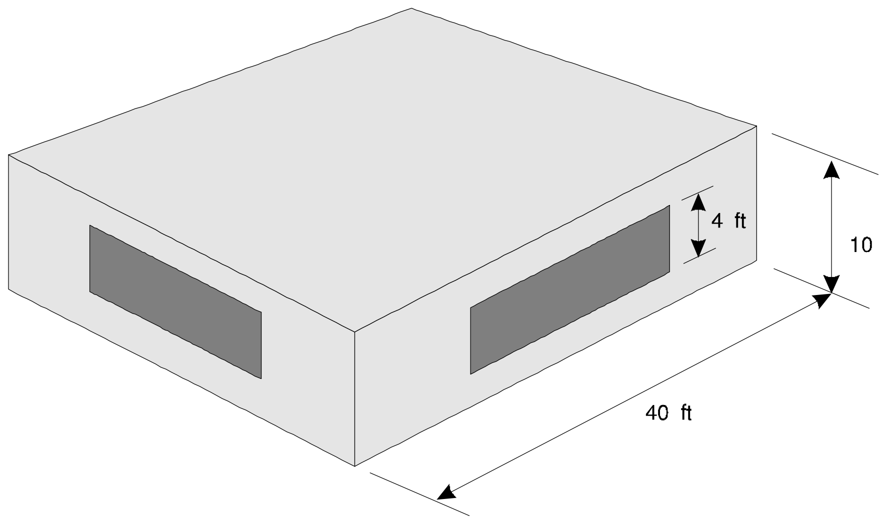

Figure 5-1 - Prototype Buildings A and B

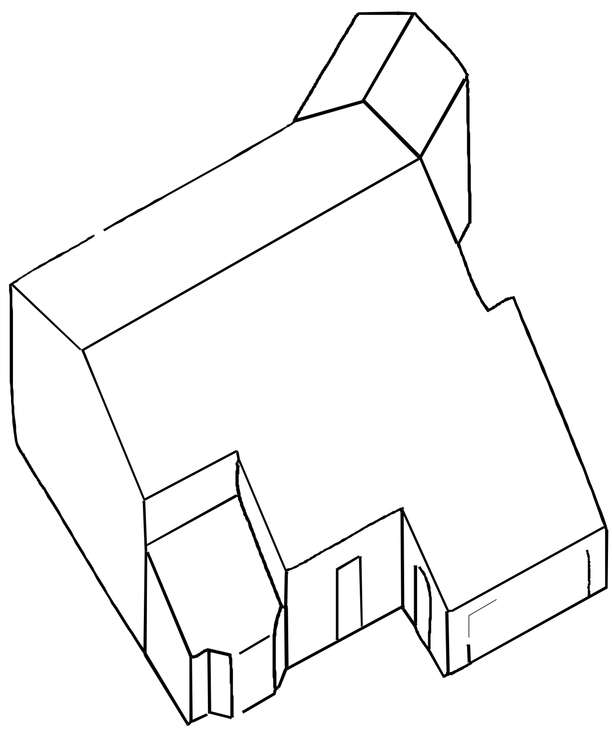

Figure 5-2 - Prototype C

Prototype buildings A and B have the same conservation features in all climate zones (see Table 5-1 below). The specific values associated with each of the basecase conservation measures is also summarized in the CALRES98 input files available from the Commission (see footnote 1 for this Chapter).

Table 5-1 - Basecase Conditions for Prototypes A and B

Component	Basecase Level	Notes
Roof U-value	0.034	
Wall U-value	0.088	
Floor U-value	0.037	
Slab F2 factor	0.76	4
Door U-value	0.330	
Thermal Mass	Slab 20% exposed, 80% covered	3
SHGC (exterior device) - (bugscreen)	0.76	
SHGC (interior)	0.68	
SHGC (fenestration - includes framing)	0.70	
Window type	Sliders	5
Fenestration U-Value	0.75	
Gas furnace AFUE	0.78	1
Air conditioner SEER	10.0	
HVAC ducts	R-4.2 Ducts in Attic	2
SLA	4.9	6

Notes:

1 The AFUE(eff) is 0.7629 when the heat contribution and energy use of the fan is considered.

2 Duct efficiencies are as described for the standard design in Chapter 3 using the default values for an air conditioner with 36,000 Btu/hr cooling capacity.

3 Prototype B has thermal mass equivalent to 5% of the raised floor area in 2 inch thick exposed concrete per Section 3.6..

4 Assumes 80% of the slab at building perimeter is carpeted or covered.

5 The default natural ventilation assumptions are used. 10% of the window area is operable (half of this is inlet and half is outlet). Height difference between inlet and outlet is 2 feet.

6 Based on having ducts in unconditioned attic space.

The computer runs used to generate the ACM tests are based on the standard modeling assumptions described in Chapter 4. Copies of these computer runs are available to assist candidate ACMs in setting their programs up for CEC approval. These input files may be obtained by writing the Residential Buildings Office, California Energy Commission, 1516 Ninth Street (MS-25), Sacramento, California 95814.

5.2 Labeling Computer Runs

Each computer run used to test the minimum space conditioning capabilities is given a precise designation to make it easier to keep track of the runs and to facilitate analysis. The following scheme is used:

12 A 04

Variation on the basecase building used to test minimum space conditioning capabilities (usually the same as the test number)

Prototype A

Climate zone 12

5.2.1 Basecase Runs

The first series of runs establish the basecase against which the other runs are compared. The variation number for the basecase run is "00". The basecase energy use is calculated for prototype A in all sixteen climate zones. The energy usage for the other prototypes is calculated only for climate zones 3, 9, 12, 14 and 16. It is important to note that only two input files are required for these computer runs since measures do not change from climate zone to climate zone. The label for these tests are shown in the table below. Total of 21 Runs.

Table 5-2 - Basecase Run Labels

	Building Prototype	
Climate Zone	**A**	**B**
1	01A00	_
2	02A00	_
3	03A00	03B00
4	04A00	_
5	05A00	_
6	06A00	_
7	07A00	_
8	08A00	_
9	09A00	09B00
10	10A00	_
11	11A00	_
12	12A00	12B00
13	13A00	_
14	14A00	14B00
15	15A00	_
16	16A00	00B16

5.2.2 Test One

The purpose of the first test is to check the prediction of the ACM for relative heating and cooling loads. The heating efficiency is increased and the cooling equipment efficiency is decreased. When the changes in heating and cooling efficiency are made, additional energy use must result. *Total of 19 Runs.*

Table 5-3 - Test One Inputs

Run Label	New Heating Efficiency	New Cooling Efficiency
02A01	0.85	8.0
03A01	0.85	5.5
04A01	0.85	7.0
05A01	0.85	5.5
06A01	0.95	6.5
07A01	0.95	7.0
08A01	0.95	7.5
09A01	0.95	8.0
10A01	0.95	8.5
11A01	0.95	8.1
12A01	0.95	7.8
13A01	0.95	8.8
14A01	0.95	8.4
16A01	0.85	5.5
03B01	0.85	6.0
09B01	0.95	8.8
12B01	0.95	7.5
14B01	0.95	8.2
16B01	0.85	5.8

5.2.3 Test Two

Test two is similar to test one except that the cooling efficiency is increased and the heating efficiency is decreased, just the opposite of test one. When the changes in heating and cooling efficiency are made, additional energy use must result. *Total of 19 Runs.*

Table 5-4 - Test Two Inputs

Run Label	New Heating Efficiency	New Cooling Efficiency
02A02	0.65	12.5
03A02	0.72	12.5
04A02	0.66	12.5
05A02	0.65	12.5
06A02	0.55	12.5
07A02	0.50	12.5
08A02	0.49	12.5
09A02	0.45	12.5
10A02	0.45	12.5
11A02	0.63	12.5
12A02	0.62	12.5
13A02	0.52	12.5
14A02	0.57	12.5
16A02	0.75	12.5
03B02	0.70	12.5
09B02	0.46	12.5
12B02	0.61	12.5
14B02	0.59	12.5
16B02	0.74	12.5

5.2.4 Test Three

Test three is performed only for prototype A in five climate zones, 3, 9, 12, 14 and 16. The ceiling U-value is reduced to 0.023 from the basecase of 0.033. The south glass area is increased a specific amount for each climate zone. Each of these computer runs must result in greater energy use than the prototype A basecase. *Total of five runs.*

Table 5-5 - Test Three Inputs

Run Label	Roof U-value	South Glass Area
03A03	0.023	200
09A03	0.023	120
12A03	0.023	140
14A03	0.023	160
16A03	0.023	160

5.2.5 Test Four

Test four is performed only for prototype A in five climate zones, 3, 9, 12, 14 and 16. The wall U-value is reduced to 0.060 from the basecase of 0.088. The west glass area is increased a specific amount for each climate zone. Each of these computer runs must result in greater energy use than prototype A. *Total of five runs.*

Table 5-6 - Test Four Inputs

Run Label	Wall U-value	West Glass Area
03A04	0.060	170
09A04	0.060	130
12A04	0.060	119
14A04	0.060	121
16A04	0.060	150

5.2.6 Test Five

Test five is performed only for prototype A in five climate zones, 3, 9, 12, 14 and 16. R-7 slab edge insulation is added, i.e. an F2 factor of 0.65 is used instead of the 0.76 used in the basecase. The north glass area is increased a specific amount for each climate zone. Each of these computer runs must result in greater energy use than prototype A. *Total of five runs.*

Table 5-7 - Test Five Inputs

Run Label	**F2 Factor**	**North Glass Area**
03A05	0.51	220.5
09A05	0.51	150
12A05	0.51	170
14A05	0.51	160
16A05	0.51	180

5.2.7 Test Six

Test six is performed only for prototype A in four climate zones: 9, 12, 14 and 16. The glazing U-value is changed to 0.54 instead of the 0.75 used in the basecase. The north glass area is increased a specific amount for each climate zone. Each of these computer runs must result in greater energy use than prototype A. *Total of four runs.*

Table 5-8 - Test Six Inputs

Run Label	Glazing U-value	North Glass Area
09A06	0.54	192
12A06	0.54	286
14A06	0.54	269
16A06	0.54	300

5.2.8 Test Seven

Test seven is performed only for prototype A in five climate zones: 3, 9, 12, 14 and 16. The fenestration U-value is increased to 1.28 (single glass) from the basecase 0.75 (mild climate zone standard) . The solar heat gain coefficients for the window are also changed to account for the single glass ($SHGC_{fen}$ = 0.80). The glass area is reduced uniformly on all orientations. Ventilation area also varies with glass area, remaining at 10% of the total area. Each of these computer runs must result in greater energy use than prototype A. *Total of five runs*

Table 5-9 - Test Seven Inputs

Run Label	Glass U-value	$SHGC_{fen}$	Glass Area on Each Orientation
03A07	1.28	0.80	55
09A07	1.28	0.80	71
12A07	1.28	0.80	65
14A07	1.28	0.80	63
16A07	1.28	0.80	51

5.2.9 Test Eight

Test eight is performed only for prototype A in five climate zones: 3, 9, 12, 14 and 16. The percent of the slab-on grade that is exposed thermal mass is increased: 500 ft^2 is exposed and 1100 ft^2 is carpeted. The slab edge heat loss, however, is unaffected; the F2 factor remains at 0.76. The south glass area is increased a specific amount for each climate zone. Each of these computer runs must result in greater energy use than prototype A. *Total of five runs.*

Table 5-10 - Test Eight Inputs

Run Label	Exposed Mass	South Glass Area
03A08	31.25%	195
09A08	31.25%	128
12A08	31.25%	131
14A08	31.25%	160
16A08	31.25%	128

5.2.10 Test Nine

Test nine is identical to test eight except west glass area is increased. This test is performed only for prototype A in five climate zones: 3, 9, 12, 14, and 16. Each of these computer runs must result in greater energy use than prototype A. *Total of five runs.*

Table 5-11 - Test Nine Results

Run Label	Exposed Mass	West Glass Area
03A09	31.25%	158
09A09	31.25%	131
12A09	31.25%	118
14A09	31.25%	113
16A09	31.25%	128

5.2.11 Test Ten

Test ten is identical to test eight except north glass area is increased. This test is performed only for prototype A in five climate zones: 3, 9, 12, 14 and 16. Each of these computer runs must result in greater energy use than prototype A. *Total of five runs.*

Table 5-12 - Test Ten Results

Run Label	Exposed Mass	North Glass Area
03A10	31.25%	152
09A10	31.25%	199
12A10	31.25%	141
14A10	31.25%	126
16A10	31.25%	112

5.2.12 Test Eleven

Test eleven is identical to test eight except east glass area is increased. This test is performed only for prototype A in five climate zones: 3, 9, 12, 14 and 16. Each of these computer runs must result in greater energy use than the prototype A basecase. *Total of five runs.*

Table 5-13 - Test Eleven Results

Run Label	Exposed Mass	East Glass Area
03A11	31.25%	184
09A11	31.25%	150
12A11	31.25%	127
14A11	31.25%	117
16A11	31.25%	119

5.2.13 Test Twelve

Test twelve is performed only for prototype A in five climate zones, 3, 9, 12, 14 and 16. The floor is changed from a slab-on-grade floor to a raised wooden floor over a crawl space with an overall U-value of 0.037. Exterior shading devices are used in other climate zones 9, 12 and 14 on all windows, to achieve the $SHGC_{fen}$ values indicated below. Glass area on the west facade is increased a specific amount for each climate zone. Each of these computer runs must result in greater energy use than prototype A. *Total of five runs.*

Table 5-14 - Test Twelve Inputs

Run Label	Raised Floor - U-value	$SHGC_{fen}$	West Glass Area
03A12	0.037	0.80	64
09A12	0.037	0.40	180
12A12	0.037	0.40	125
14A12	0.037	0.40	140
16A12	0.037	0.80	120

5.2.14 Test Thirteen

In test thirteen, an interior shading device is used on all windows which has a solar heat gain coefficient of 0.47 when the device is used with single pane, metal-framed fenestration ($SHGC_{fen}$ = 0.80) and is closed. The area of south glass is increased a specific amount for each climate zone. This test is performed for the prototype A building in five climates. Each of these computer runs must result in greater energy use than the prototype A basecase. *Total of five runs.*

Table 5-15 - Test Thirteen Inputs

Run Label	SHGC Interior Shade	South Glass Area
03A13	0.47	200
09A13	0.47	200
12A13	0.47	222
14A13	0.47	244
16A13	0.47	160

5.2.15 Test Fourteen

Test fourteen evaluates how the ACM treats south overhangs. It is performed for the prototype A building in five climate zones: 3, 9, 12, 14 and 16. In each case a south overhang is added to the building. The overhang has a two foot projection from the surface of the south glass. Its bottom edge is located six inches above the top of the window. It is assumed that the south glazing consists of six-foot six-inch high windows.

The overhang is assumed to extend an infinite distance beyond the sides of the windows. The overhang characteristics are illustrated below. South glazing area is then increased by increasing its width. Each case must result in greater energy use than prototype A. *Total of five runs.*

Table 5-16 - Test Fourteen Inputs

Run Label	South Overhang	South Glass Area
03A14	yes	169
09A14	yes	132
12A14	yes	144
14A14	yes	129
16A14	yes	100

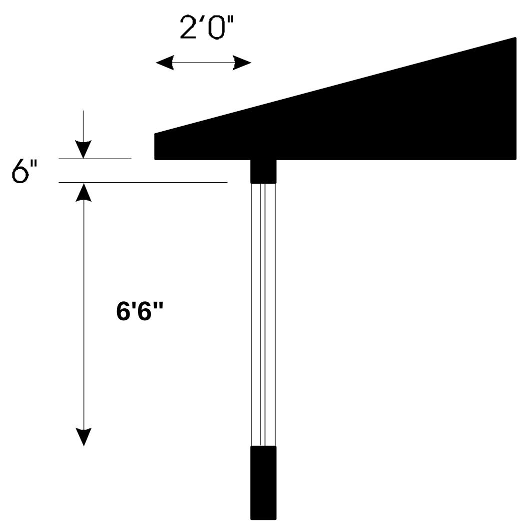

Figure 5-3 - Overhang Characteristics

5.2.16 Test Fifteen

This test is for the infiltration and ventilation model. It is performed for the prototype A building in five climate zones: 3, 9, 12, 14 and 16. The basecase building has ducts in unconditioned space, therefore, the fixed and restricted inputs specify a SLA of 4.9. In this test building leakage is reduced to an SLA of 2.9 by infiltration reduction measures and is modeled with and without 80 cfm (0.375 air changes per hour) of mechanical ventilation which consumes 20 watts of power continuously. Glass area is increased on all orientations so that the building fails to comply. *Total of ten runs*.

Table 5-17 - Test Fifteen Inputs

Run Label	Specific Leakage Area	Fan Volume & Wattage	Maximum Glass Area on Each Orientation A/B
03A15A	2.90	0 cfm/0 watts	110
03A15B	2.90	80 cfm/20 watts	131
09A15A	2.90	0 cfm/0 watts	96
09A15B	2.90	80 cfm/20 watts	100
12A15A	2.90	0 cfm/0 watts	80
12A15B	2.90	80 cfm/20 watts	100
14A15A	2.90	0 cfm/0 watts	80
14A15B	2.90	80 cfm/20 watts	100
16A15A	2.90	0 cfm/0 watts	72
16A15B	2.90	80 cfm/20 watts	100

5.3 Water Heating Tests

Testing of ACM minimum capabilities for water heating is completely separate from the space conditioning tests. One of the principal differences between water heating and space conditioning is that fixed energy budgets are used for water heating rather than custom budgets. The testing procedures are, therefore, fundamentally different. Candidate ACMs must exactly replicate the results of the official CEC water heating methodology for various system types.

5.3.1 Prototype Water Heaters

There are seven water heaters that are used for the tests. These systems are labeled E, F, G, and J. Detailed specifications for each water heating system are given in Table 5-18 below. The energy use of each of the water heating systems is calculated with several distribution systems.

Table 5-18 - Water Heating Systems

		E	**F**	**G**	**J**
System Level Information					
Climate Zone		3	7	16	5
Dwelling Units		10	1	1	3
Average Dwelling Unit Size		1200	1500	3500	800
Number of Water Heaters		5	1	2	6
Water Heating Equipment					
Water Heater Type		LG	HP	HP	IE
Energy Factor (Note 1)		0.77	2.00	1.80	0.95
Tank Size	Gal	100	50	75	na.
Standby Loss	%	3%.	n.a.	n.a.	n.a.
Input Rating	kBtu/h	100	n.a.	n.a.	n.a.

Notes
1. For instantaneous gas (IG) and large gas (LG) water heaters the value reported in this row is the recovery efficiency or thermal efficiency.

5.3.2 Labeling Computer Runs

Each water heating calculation is given a precise designation to make it easier to keep track of the runs and to facilitate analysis. The following scheme is used:

12 F POU

Distribution system type

Prototype water heater system F

Climate zone 12

5.3.3 Test Results

Water heater types E, F, G, and J are analyzed in just one climate zone (except for heat pumps, the results should not change by climate zone). The results must exactly replicate the values shown in the following tables. A summary sheet is provided in Appendix A that must be completed by the vendor. *Total of 40 calculations.*

Table 5-19 - Water Heater Results (kBtu/yr)

			E	F	G	J
Energy Budget			221.900	23.645	28.495	60.750
Distribution System	DSM Single Fam.	DSM MultiFam.				
Standard	1.00	1.00	218.208	18.064	49.731	85.085
POU/HWR	0.82	1.00	218.208	15.875	43.940	85.085
Pipe Insulation	0.92	0.92	207.304	17.100	47.178	78.278
Recirc/NoControl	1.52	1.52	289.082	24.060	65.630	129.329
Recirc/Timer	1.28	1.52	289.082	21.345	58.427	129.329
Recirc/Demand	0.98	1.52	289.082	17.824	49.096	129.329
Recirc/Time+Temp	0.96	1.52	289.082	17.583	48.459	129.329
Recirc/Temp	1.05	1.05	225.023	18.660	51.310	89.339
Parallel Piping	0.86	0.86	199.126	16.367	45.242	73.123

5.4 Standard Design Generator Tests

The standard design generator must automatically define the standard design which is the basis of the custom budget. The standard design run is made automatically at the same time as the proposed design run, and the results are reported together on the Computer Method Summary discussed in Chapter 2. This test verifies that the standard design is correctly defined for the proposed design and that the custom budget is correctly calculated.

The standard design test consists of matched pairs of computer runs: a proposed design and its standard design equivalent. The standard design equivalent is the proposed design reconfigured according to the standard design rules in Chapter 3.

Two Computer Method Summaries are produced: one for the proposed design and one for the standard design equivalent. The standard design energy budget on the proposed design Computer Method Summary must be equal to the energy use shown in both the standard design energy budget and proposed design columns of the standard design equivalent computer run.

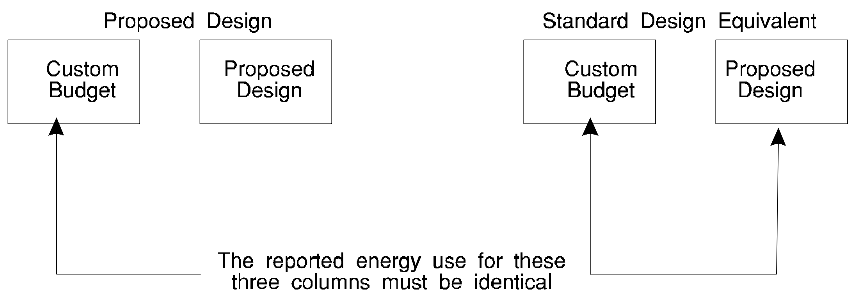

Figure 5-4 - Custom Budget Tests

5.4.1 Slab Floor Test

The purpose of this test is to verify that the standard design generator correctly defines the standard design for proposed designs using slab-on-grade designs. Package D is now the basis of the standard design for all buildings including slab-on-grade buildings. The rules for determining how much thermal mass is modeled in buildings with both raised and slab-on-grade construction are contained in Chapters 3 and 4. The prototype C variation used for this test has both raised floors and slab-on-grade floors.

Prototype "xxC31" is run in all sixteen climate zones, and the standard design equivalent in each climate zone is also run. The results must be exactly identical as discussed above. The labels for this series of runs are summarized in the following table. *Total of 32 runs.*

Table 5-20 - Slab Floor Standard Design Tests

Climate Zone	Proposed Design	Standard Design Equivalent
1	01C31	01C31C
2	02C31	02C31C
3	03C31	03C31C
4	04C31	04C31C
5	05C31	05C31C
6	06C31	06C31C
7	07C31	07C31C
8	08C31	08C31C
9	09C31	09C31C
10	10C31	10C31C
11	11C31	11C31C
12	12C31	12C31C
13	13C31	13C31C
14	14C31	14C31C
15	15C31	15C31C
16	16C31	16C31C

5.4.2 Raised Floor Test

The purpose of this test is to verify that the standard design generator correctly defines the standard design for a proposed design for a dwelling with a raised floor. This is a parallel test to the previous one except that a modification of the prototype building is used which is the prototype C building with no slab floor but with 5% of the nonslab floor covered with 2 inches of exposed concrete. This modification is labeled "xxC32" and is contained in Appendix C in the standard format of the Computer Method Summary.

The modified prototype C building is run in all sixteen climate zones, and the standard design equivalent in each climate zone is also run. The results must be exactly identical. The labels for this series of runs are summarized in the following table. *Total of 32 runs.*

Table 5-21 - Raised Floor Standard Design Tests

Climate Zone	Proposed Design	Standard Design Equivalent
1	01C32	01C32C
2	02C32	02C32C
3	03C32	03C32C
4	04C32	04C32C
5	05C32	05C32C
6	06C32	06C32C
7	07C32	07C32C
8	08C32	08C32C
9	09C32	09C32C
10	10C32	10C32C
11	11C32	11C32C
12	12C32	12C32C
13	13C32	13C32C
14	14C32	14C32C
15	15C32	15C32C
16	16C32	16C32C

5.4.3 Electric Heat Test

The purpose of this test is to verify that the standard design generator correctly defines the standard design for proposed designs with electric heating systems. This a parallel test to the previous custom budget tests, except that a modification of the prototype building is used. This modification is labeled "xxC33" and is contained in Appendix C in the standard format of the Computer Method Summary.

The modified prototype C building with electric resistance heating is run in all sixteen climate zones, and the standard design equivalent which uses an electric heat pump with an HSPF of 6.8 in each climate zone is also run. The results for the *Standard Designs* for both runs and the *Proposed Design* for the *Standard Design* equivalent must be exactly identical. The labels for this series of runs are summarized in the following table. *Total of 32 runs.*

Table 5-22 - Electric Heat Standard Design Tests

Climate Zone	Proposed Design	Standard Design Equivalent
1	01C33	01C33C
2	02C33	02C33C
3	03C33	03C33C
4	04C33	04C33C
5	05C33	05C33C
6	06C33	06C33C
7	07C33	07C33C
8	08C33	08C33C
9	09C33	09C33C
10	10C33	10C33C
11	11C33	11C33C
12	12C33	12C33C
13	13C33	13C33C
14	14C33	14C33C
15	15C33	15C33C
16	16C33	16C33C

5.4.4 HVAC Distribution Efficiency Tests

The Standard Design uses the defaults of the HVAC distribution efficiency calculation method found in Appendix F to determine the HVAC distribution efficiency. These defaults result in seasonal HVAC distribution efficiencies of about 72-76% depending on the climate zone. The calculation method detailed in Appendix F gives efficiency credits for certain specific improvements in the HVAC distribution system, such as, higher duct insulation levels, careful duct design and layout, and reduced duct leakage due to better sealing techniques. HVAC distribution efficiency improvements must be independently verified and some are subject to site diagnostic testing by a certified HERS rater.

For these tests prototype building A is used. For the first series of tests, the ducts are designed to conform to ACCA Manual D specifications with room-by-room load calculations and have a duct layout design on the plans. The ducts are sealed and are modeled with total duct leakage of less than 6%. Roof insulation is reduced until the building fails to comply.

Table 5-23 - Additions Tests Inputs

Run Label	ACCA Manual D Design	Measured Reduced Duct Leakage	Maximum Roof /Ceiling U-value
03A34	Yes	<6%	0.073
09A34	Yes	<6%	0.082
12A34	Yes	<6%	0.066
14A34	Yes	<6%	0.094
16A34	Yes	<6%	0.066
03A35	No	<6%	0.052
09A35	No	<6%	0.043
12A35	No	<6%	0.043
14A35	No	<6%	0.043
16A35	No	<6%	0.040

For the second series of tests, duct location is run for six tests with 10 lineal feet of ducts and the air handler are in an unconditioned garage and the remainder of the ducts are in conditioned space. The tests are rerun with all of the ducts and the air handler in the conditioned space. For all of the tests in this series, duct leakage is reduced to less than 6% of the fan flow. Roof insulation is reduced until the building fails to comply

Table 5-24 - Additions Tests Inputs

Run Label	Duct Location	Measured Reduced Duct Leakage	Maximum Roof /Ceiling U-value
03A36	Cond./InEx12	<6%	0.094
09A36	Cond./InEx12	<6%	0.082
12A36	Cond./IInEx12	<6%	0.094
14A36	Cond./IInEx12	<6%	0.118
16A36	Cond./IInEx12	<6%	0.127

The ACM or its research version must report the duct efficiencies for the HVAC distribution efficiency tests.

5.4.5 Addition Plus Existing Building Test

Additions are treated as new buildings except that internal heat gains are allocated on a fractional dwelling unit basis. When an addition is modeled in conjunction with an existing building, energy credit may be taken for improvements to the existing building. This series of tests exercises the various default assumptions based on the vintage of the existing building and the various reporting requirements for modeling an addition with an existing building. In addition, these tests verify the proper determination of the energy budget and compliance criteria for an addition with an improved existing building.

For these tests the existing building has the same physical configuration as Prototype A but has single pane, metal-framed windows on all four sides with a window on each vertical elevation that is 4’ high and 20’ wide centered on the facade. The 12’ deep by 40’ long addition covers the whole west side of the existing building. The addition faces west and has west-facing glazing with a U-value of 0.75 and an $SHGC_{fen}$ of 0.70. The addition covers 80 ft^2 of existing glass. For test series 37, the mandatory minimum R-values are used in the addition’s roof/ceiling and walls. Hence for test series 37, the U-value for the roof/ceiling of the addition is 0.047 corresponding to R-19 insulation and the wall U-value is 0.088 corresponding to R-13 wall insulation. For test series 38, the existing building’s roof and the addition roof insulation is brought up to the requirements for a new dwelling. The addition’s west-facing glazing is increased until the building no longer complies with the budget determined from modeling the existing building and modeling the addition and area weighting the heating and cooling budgets for those runs.

These tests will also be used to confirm that output requirements are met when modeling an addition with an existing building and that the appropriate budgets have been correctly determined.

Table 5-25 - Additions Tests Inputs

Run Label	Vintage of Existing Building	$SHGC_{fen}$	Covered Existing Glazing	U-Value of Roof/Ceiling Existing/Add.	West-Facing Glazing for the Addition (ft^2)
03D37	1977	0.70	80 ft^2	0.077/0.047	380
09D37	1977	0.70	80 ft^2	0.077/0.047	270
12D37	1977	0.70	80 ft^2	0.077/0.047	320.
14D37	1977	0.70	80 ft^2	0.077/0.047	360
16D37	1977	0.70	80 ft^2	0.077/0.047	370
03D38	1989	0.70	80 ft^2	0.034/0.034	20
09D38	1989	0.70	80 ft^2	0.034/0.0-34	100
12D38	1989	0.70	80 ft^2	0.034/0.034	80
14D38	1989	0.70	80 ft^2	0.028/0.028	80
16D38	1989	0.70	80 ft^2	0.028/0.028	8